(User no) AF/1763
14-#

Attorney's Docket No. 5649-842

APPELLANTS' BRIEF ON APPEAL

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re: Kang et al.
Serial No.: 09/665,208
Filed: September 18, 2000
For: APPARATUS FOR FORMING THIN FILM

Confirmation No.: 4274
Group Art Unit: 1763
Examiner: T. Dang

Date: December 3, 2002

BOX AF
Commissioner for Patents
Washington, DC 20231

TRANSMITTAL OF APPEAL BRIEF
(PATENT APPLICATION--37 C.F.R. § 1.192)

1. Transmitted herewith, in triplicate, is the APPEAL BRIEF in this application, with respect to the Notice of Appeal filed on October 3, 2002.

2. This application is filed on behalf of
   ☐ a small entity
   A verified statement ☐ is attached; ☐ was already filed.

3. Pursuant to 37 C.F.R. § 1.17(c), the fee for filing the Appeal Brief is:
   ☐ small entity $160.00
   ☒ other than small entity $320.00

   Appeal Brief fee due $320.00

   ☒ The Appeal Brief fee and any additional fee or refund may be charged to Deposit Account 50-0220.

Respectfully requested,

Devin R. Jensen
Registration No. 44,805


20792
PATENT TRADEMARK OFFICE

CERTIFICATE OF MAILING

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to: BOX AF, Commissioner for Patents, Washington, DC 20231, on December 3, 2002.

Monica L. Croom
Monica L. Croom

14

Attorney's Docket No. 5649-842 **APPELLANTS' BRIEF ON APPEAL**

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re: Kang et al.
Serial No.: 09/665,208
Filed: September 18, 2000
For: APPARATUS FOR FORMING THIN FILM

Confirmation No.: 4274
Group Art Unit: 1763
Examiner: T. Dang

Date: December 3, 2002

BOX AF
Commissioner for Patents
Washington, DC 20231

APPELLANTS' BRIEF ON APPEAL UNDER 37 C.F.R. § 1.192

Sir:

This Appeal Brief is filed pursuant to the "Notice of Appeal to the Board of Patent Appeals and Interferences" filed on October 3, 2002 and is filed in triplicate pursuant to 37 C.F.R. 1.192.

REAL PARTY IN INTEREST

The real party in interest is Samsung Electronics Co., Ltd., a Korean corporation having a principal place of business at 416 Maetan-dong, Paldal-gu, Suwon-City, Kyungki-do, Republic of Korea, the Assignee of this application.

RELATED APPEALS AND INTERFERENCES

Appellants are unaware of any related appeals and/or interferences that will directly or indirectly affect this Appeal or have any bearing on the Board's decision in this appeal.

STATUS OF CLAIMS

Claims 23-25, 27-35, and 45-66 are pending in the case and stand rejected.

Claims 23-25 and 30 stand rejected under 35 U.S.C. § 102(e) as being anticipated by Bhatnagar (United States Patent No. 6,029,602).

Claims 28, 29, 31-35, and 46-50 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Bhatnagar (United States Patent No. 6,029,602) in view of Henley et al. (United States Patent No. 6,207,005).

Claim 30 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Shang

et al. (United States Patent No. 6,055,927).

Claims 27-29, 45, and 51-66 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Shang et al. (United States Patent No. 6,055,927) in view of Kuwabara et al. (United States Patent No. 5,534,069).

STATUS OF AMENDMENTS

A response to the Final Office Action was filed on June 7, 2002. The amendment proposed to cancel Claims 36-44 without prejudice. The Advisory Action mailed on July 1, 2002, indicated that the amendments recited in the response to the Final Office Action would be entered for the purposes of this Appeal. The Advisory Action also indicated that the outstanding rejections of Claims 23-25, 27-35, and 45-66 were maintained as in the Final Office Action. A Notice of Appeal was filed on October 3, 2002.

SUMMARY OF THE INVENTION

The present invention relates to an apparatus for forming films on substrates, and in particular, an apparatus for forming thin films such as electrodes and dielectric layers. The apparatus includes an oxygen radical or plasma annealing unit connected to a multi-functional chamber. *See, Specification* at p. 19, lines 10-12. Oxygen radicals or plasma provided by the oxygen radical or plasma annealing unit may be used to oxygen radical or plasma anneal a lower electrode, dielectric layer, or an upper electrode to a semiconductor wafer. *See, Id.* at lines 14-17. The apparatus may also include a loadlock chamber for loading semiconductor wafers into the apparatus. *See, Id.* at lines 1-2. A transfer chamber for transferring semiconductor wafers between various portions of the apparatus may also be included with the apparatus. *See, Id.* at lines 3-9.

The multi-functional chamber of the apparatus of the present invention may include a supporting plate for holding semiconductor wafers or substrates. *See, Specification* at p. 20, lines 8-10. A heater, such as a lamp, for controlling the temperature of a semiconductor wafer or substrate on the supporting plate is positioned under the supporting plate. *See, Id.* at lines 12-19. A source dispersion device, such as a shower head type dispersion device, is

positioned over the supporting plate for dispersing gas into the multi-functional chamber. *See, Id.* at lines 19-22. A source supplier for providing a source gas to the source dispersion device is in fluid communication with the source dispersion device. *See, Id.* at lines 21-22. The source supplier includes an organic source for supplying an organic source solution to be used in the deposition processes carried out in the multi-functional chamber. *See, Id.* at p. 20, line 23 – p. 21, line 18. The organic source is in fluid communication with a flow controller, which in turn, is in fluid communication with one or more evaporators. *See, Id.* A transfer gas source may be in communication with the evaporators for providing a transfer gas to the evaporator to be mixed with evaporated organic source gas and delivered to the multi-functional chamber. *See, Id.*

An oxygen radical annealing unit connected to the multi-functional chamber comprises an ozone generator for performing an ozone annealing process within the multi-functional chamber. *See, Specification* at p. 21, lines 19-22. Oxygen and nitrogen gases are fed to the ozone generator to create ozone that is then flowed into the multi-functional chamber. *See, Id.* at lines 22-29. The apparatus may also include an ozone remover with a pump installed in an exhaust of the multi-functional device for removing ozone from the multi-functional chamber and controlling the pressure within the multi-functional chamber. *See, Id.* at p. 21, line 29 – p. 22, line 2.

A plasma generator connected to multi-functional chamber in the apparatus of the present invention includes a wave guide, magnet coils and a plasma gas source for generating plasma to be fed to the multi-functional chamber. *See, Specification* at p. 22, lines 14-21. The plasma gas source may include gas selected from the group consisting of O_2, NH_3, Ar, N_2, and N_2O. *See, Id.*

The apparatus may also include a cleaning gas source for supplying a cleaning gas to the multi-functional chamber for cleaning the walls of the multi-functional chamber. *See, Id.* at p. 22, lines 6-8.

A crystallization annealing chamber may also be used in conjunction with the multi-functional chamber for annealing and crystallizing a dielectric layer deposited in an amorphous state on a semiconductor substrate. *See, Specification* at p. 24, lines 19-23. The

crystallization annealing chamber is preferably a rapid thermal annealing furnace. *See, Id.* at lines 23-25.

According to embodiments of the present invention, "it is now possible to manufacture thin films and capacitors on substrates...such that the thin films have lower impurity levels and the capacitors have improved electrical characteristics." *See, Specification* at p. 13, lines 13-16. Further, "it is possible to reduce the leakage current by oxygen radical or plasma annealing the lower electrode after forming the lower electrode and/or oxygen radical or plasma annealing the dielectric layer after forming the dielectric layer." *See, Id.* at p. 33, lines 7-10.

ISSUES

1. Whether Claims 23-25 and 30 are anticipated under 35 U.S.C. § 102(e) by Bhatnagar (United States Patent No. 6,029,602).

2. Whether Claims 28, 29, 31-35, and 46-50 are obvious under 35 U.S.C. § 103(a) in light of the combination of Bhatnagar (United States Patent No. 6,029,602) with Henley et al. (United States Patent No. 6,207,005).

3. Whether Claim 30 is obvious under 35 U.S.C. § 103(a) in light of Shang et al. (United States Patent No. 6,055,927).

4. Whether Claims 27-29, 45, and 51-66 are obvious under 35 U.S.C. § 103(a) in light of the combination of Shang et al. (United States Patent No. 6,055,927) with Kuwabara et al. (United States Patent No. 5,534,069).

GROUPING OF CLAIMS

The appealed claims are Claims 23-25, 27-35, and 45-66. The following is the grouping of Claims for the Appeal:

(a) Claims 23, 24, 27-34, and 45-49 stand and fall together;

(b) Claim 25 stands and falls alone;

(c) Claims 35 and 50 stand and fall together;

(d) Claims 51, 52, 54, and 58-66 stand and fall together;

(e) Claims 53 and 55 stand and fall together; and

(f) Claims 56 and 57 stand and fall together.

ARGUMENT

Bhatnagar does not anticipate Claims 23-25 and 30 because Bhatnagar fails to teach all of the elements of the recited Claims. Under 35 U.S.C. § 102, "a claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." M.P.E.P. § 2131 (quoting *Verdegaal Bros. v. Union Oil Co.*, 814 F.2d 628, 631, 2 U.S.P.Q.2d 1051, 1053 (Fed. Cir. 1987)). Bhatnagar's failure to teach all of the recited elements of the Claims precludes an anticipation rejection of Claims 23-25 and 30.

For similar reasons, the remaining claims are not obvious in light of the cited references and combinations.

> To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure.

See, M.P.E.P. §2142, *citing In re Vaeck*, 947 F.2d 488, 20 U.S.P.Q.2d 1438 (Fed. Cir. 1991).

Claims 28, 29, 31-35, and 46-50 are not obvious under 35 U.S.C. § 103(a) in light of the combination of Bhatnagar with Henley et al. because the combined references fail to teach or suggest all of the claim recitations. Similarly, Claim 30 is not obvious in light of Shang et al. because Shang et al. does not teach all of the recitations of Claim 30. Further, Claims 27-29, 45 and 51-66 are also non-obvious and allowable because the combination of Shang et al. with Kuwabara et al. fails to teach or suggest all of the recitations of the claims. Claims 23-25, 27-35, and 45-66 are therefore allowable because a *prima facie* obviousness rejection is not supported. *See, In re Vaeck*, 947 F.2d 488, 20 U.S.P.Q.2d 1438 (Fed. Cir. 1991).

(a) Claims 23, 24, 27-34, and 45-49

Claims 23, 24, 27-34, and 45-49 stand and fall together. Specifically, dependent Claims 24, and 30-34, and Claims 45-49 stand and fall with Claim 23. Claims 24, and 30-34 depend, either directly or indirectly, from independent Claim 23. Claims 46-49 depend from independent Claim 45. Both independent Claims 23 and 45 recite "an oxygen radical or plasma annealing unit...comprising a gas source selected from the group consisting of O_2, NH_3, Ar, N_2, and N_2O," which is not taught or suggested by the cited prior art references.

Appellants note that the rejection of Claim 23 in the Final Office Action was included under the Section entitled "Claim Rejections – 35 USC § 103" but recites 35 U.S.C. § 102(e) as the basis for the rejection. The Final Office Action specifically states that Claim 23 is "rejected under 35 U.S.C. 102(e) as being anticipated by *Bhatnagar*." Although Appellants indicated in their response to the Final Office Action that they assumed that the rejection was actually a 35 U.S.C. § 103(a) obviousness rejection, the Office did not acknowledge the assumption. Therefore, Appellants will address the rejection of Claim 23 with respect to both an anticipation rejection under 35 U.S.C. § 102(e) and an obviousness rejection under 35 U.S.C. § 103(a) in light of Bhatnagar.

Bhatnagar fails to teach or suggest, "a gas source selected from the group consisting of O_2, NH_3, Ar, N_2, and N_2O," as recited in Claim 23. The Final Office Action impliedly admits this by alleging that, "it would have been obvious to connect the gas source recited in Claim 23 to Bhatnagar's apparatus because the type of gas to be used depends on the treatment to be performed." *See, Final Office Action* at p. 2, Section 1. Under 35 U.S.C. § 102, "a claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." *See,* M.P.E.P. § 2131 (*quoting Verdegaal Bros. v. Union Oil Co.*, 814 F.2d 628, 631, 2 U.S.P.Q.2d 1051, 1053 (Fed. Cir. 1987)). Thus, Bhatnagar fails to anticipate Claim 23 under 35 U.S.C. § 102(e) because Bhatnagar fails to expressly or inherently describe the recited gas source. Accordingly, Appellants request that the Board reverse the Examiner's rejection of Claim 23 and Claims 24, 30-34, and 45-49, which stand and fall with Claim 23, as being anticipated by

Bhatnagar. Claim 23 and Claims 24, 30-34 and 45-49 are allowable over the 35 U.S.C. § 102(e) rejection based upon Bhatnagar.

Furthermore, Claim 23 is not obvious under 35 U.S.C. § 103(a) in light of Bhatnagar for similar reasons. To establish a *prima facie* obviousness rejection a reference or a combination of references must teach or suggest all of the claimed recitations and there must be some suggestion or motivation, either in the references or to one of skill in the art, to combine the references to make obvious the claims. *See, In re Vaeck*, 947 F.2d 488, 20 U.S.P.Q.2d 1438 (Fed. Cir. 1991). Bhatnagar fails to teach or suggest the gas source recited in Claim 23 and the only motivation to use the claimed gas sources with Bhatnagar is Appellants' own Specification, which cannot be used to motivate a combination that results in a *prima facie* obviousness rejection.

As previously established, Bhatnagar fails to teach or suggest the use of "a gas source selected from the group consisting of O_2, NH_3, Ar, N_2, and N_2O," as recited in Claim 23. The Final Office Action indicates that, "it would have been obvious to connect the gas source recited in claim 23 to Bhatnagar's apparatus because the type of gas to be used depends on the treatment to be performed." Yet Bhatnagar does not disclose or suggest a situation or type of "treatment" wherein the claimed gas sources would be desirable. The only motivation to use the recited gas sources of Claim 23 in the apparatus of Bharnagar is Appellants' own Specification. The Appellants' Specification, however, may not be used to motivate a *prima facie* obviousness rejection. Therefore, the rejection of Claim 23, and the claims that stand and fall with Claim 23, as being obvious in view of Bhatnagar should be reversed because no motivation exists to combine the claimed gas sources with the Bhatnagar reference and Bhatnagar fails to teach or suggest all of the claim limitations. *See, In re Vaeck*, 947 F.2d 488, 20 U.S.P.Q.2d 1438 (Fed. Cir. 1991).

Claim 27 is dependent upon Claim 23. Although Claim 27 stands rejected under 35 U.S.C. § 103(a) in light of the combination of Shang et al. with Kuwabara et al., Claim 27 stands and falls with Claim 23 as a dependent claim thereof. Claims 28 and 29 also stand and fall with Claim 23 as dependent claims of Claims 27 and 28, respectively.

Appellants also note that Claims 27 and 45 recite "a source dispersion device

positioned above the support plate and configured to uniformly disperse organic source liquid." For clarity, the recitation of "liquid" should be "gas."

(b) Claim 25

Claim 25 stands and falls alone. Claim 25 recites, "the apparatus of Claim 24, wherein the multi-functional chamber further comprises an ozone remover connected to an exhaust end of the multi-functional chamber." According to the Final Office Action, Claim 25 is anticipated by Bhatnagar under 35 U.S.C. § 102(e) or is obvious in light of Bhatnagar under 35 U.S.C. § 103(a). However, the failure of Bhatnagar to teach or suggest "an ozone remover" as recited in Claim 25 precludes both an anticipation rejection and an obviousness rejection.

Under 35 U.S.C. § 102, "a claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." M.P.E.P. § 2131 (quoting *Verdegaal Bros. v. Union Oil Co.*, 814 F.2d 628, 631, 2 U.S.P.Q.2d 1051, 1053 (Fed. Cir. 1987)). Bhatnagar's failure to expressly or inherently describe "an ozone remover" as claimed precludes the anticipation rejection of Claim 25. Similarly, a *prima facie* obviousness rejection will only stand if the prior art reference teaches or suggests all of the claim limitations. *See, In re Vaeck*, 947 F.2d 488, 20 U.S.P.Q.2d 1438 (Fed. Cir. 1991). The lack of teaching of "an ozone remover" in Bhatnagar precludes a *prima facie* obviousness rejection. Therefore, Claim 25 is allowable over the outstanding rejections, and Appellants request that the Board reverse the Examiner's rejection of Claim 25.

(c) Claims 35 and 50

Claims 35 and 50 stand and fall together. Claims 35 and 50 each stand rejected under 35 U.S.C. § 103(a) as being obvious in light of the combination of Bhatnagar with Henley et al. Claim 35 depends from Claim 31, which in turn depends from independent Claim 23. Claim 50 depends from Claim 46, which in turn depends from independent Claim 45. Although Claims 35 and 50 depend from different independent claims, each of Claims 35 and 50 recite "a cooling chamber connected to the transfer chamber," which is not taught or

suggested by the combination of prior art.

In rejecting Claims 35 and 50, the Final Office Action references the previous Office Action (Paper No. 6), which rejects the claims on the basis that it would be obvious to incorporate Bhatnagar's apparatus with Henley et al, which allegedly "teaches that it is conventional in the art to have a cluster tool assembly in which a load lock and multiple processing chambers...are connected to a wafer transfer chamber." *See, Office Action Paper No. 6* at p. 3, Section 4. Even if it were obvious to combine Bhatnagar's apparatus with a cluster tool assembly allegedly taught by Henley et al., neither reference teaches or suggests the inclusion of "a cooling chamber connected to the transfer chamber" as recited in Claims 35 and 50. A *prima facie* obviousness rejection may only stand, however, if the references, when combined, teach or suggest all of the claim limitations. The lack of any teaching of a cooling chamber as claimed precludes the *prima facie* obviousness rejection under 35 U.S.C. § 103(a). Accordingly, Appellants request that the Board reverse the Examiner's rejection of Claims 35 and 50 as being obvious over Bhatnagar in view of Henley.

(d) Claims 51, 52, 54, and 58-66

Claims 51, 52, 54, and 58-66 stand and fall together. Claims 51, 52, 54, and 58-66 stand rejected under 35 U.S.C. § 103(a) as being obvious in light of the combination of Shang et al. with Kuwabara et al. More particularly, the Final Office Action indicates that the claims "basically are related to intended use of the claimed apparatus but they fail to define the claimed invention structurally over that of prior art." However, the cited references fail to teach or suggest all of the claim limitations of Claim 51, therefore, Claim 51, and Claims 52, 54, and 58-66, which depend on Claim 51, are allowable.

For example, Claim 51 recites, in part, a "means for forming an upper electrode on the oxygen radical or plasma annealed dielectric layer." The cited references fail to teach or suggest such a feature. Shang et al. fails to disclose a means for forming an electrode. Kuwabara et al. does not disclose the recited means for forming an upper electrode. Thus, Kuwabara et al. fails to make obvious Claim 51. Because the cited references fail to teach or suggest all of the claim limitations a *prima facie* obviousness rejection is not established.

Accordingly, Appellants request that the Board reverse the Examiner's rejection of Claims 51, 52, 54, and 58-66, as being obvious over Shang et al. in view of Kuwabara et al.

(e) Claims 53 and 55

Claims 53 and 55 stand and fall together. Claim 53 recites, in part, "a means for exposing the dielectric layer to an atmosphere comprising an oxygen radical," which recitations are not taught or suggested by the references cited in the Final Office Action. Claim 55 depends form Claim 53 and is allowable as a dependent claim thereof.

Claim 53 stands rejected under 35 U.S.C. § 103(a) based upon the combination of Shang et al. with Kuwabara et al. However, neither of the cited references, alone or in combination, discloses or teaches a means for exposing a dielectric layer to an atmosphere comprising an oxygen radical as claimed by Claim 53. The failure of the references to teach or suggest such a feature prevents the establishment of a *prima facie* case obviousness because the requirements of a *prima facie* obviousness rejection are only met if all of the elements of the claims are taught or suggested by the references or the art. *See, In re Vaeck*, 947 F.2d 488, 20 U.S.P.Q.2d 1438 (Fed. Cir. 1991). Accordingly, Appellants request that the Board reverse the Examiner's rejection of Claim 53 as being obvious over Shang et al. in view of Kuwabara et al.

(f) Claims 56 and 57

Claims 56 and 57 stand and fall alone. Claims 56 and 57 are dependent upon Claim 51 and are rejected under 35 U.S.C. § 103(a) as being obvious in light of the combination of Shang et al. and Kuwabara et al. Claim 57 is dependent upon Claim 56 and stands and falls with Claim 56.

Claim 56 specifically recites "a means for exposing the dielectric layer to an atmosphere comprising a plasma gas selected from the group consisting of O_2, NH_3, Ar, N_2 and N_2O," which is not taught by either of the combined references. The failure of the references to teach or suggest a means for providing an atmosphere comprising a plasma gas selected from the recited group of gases in Claim 56 bars the *prima facie* obviousness

rejection because all of the claim limitations are not taught or suggested by the references. *See, In re Vaeck*, 947 F.2d 488, 20 U.S.P.Q.2d 1438 (Fed. Cir. 1991). Accordingly, Appellants request that the Board reverse the Examiner's rejection of Claims 56 and 57 as being obvious in light of the combination of Shang et al. and Kuwabara et al.

(g) Response to Comments

The Final Office Action is permeated with statements regarding the intended use or function of the apparatus embodiments of the present invention. The claims do no merely recite methods of using an apparatus as alleged in the "Response to Arguments" section of the Final Office Action. Instead, the claims include specific structural recitations. For example Claim 1 recites in part "a multi-functional chamber" and "an oxygen radical or plasma annealing unit," each of which are structural recitations. Claim 45 also includes structural recitations that differentiate the claimed apparatus from the prior art. In particular, Claim 45 includes, among others, the recitations of a "multi-function chamber comprising a support plate...a heater unit...a source dispersion device...and a source supplier." Claim 45 also recites an "oxygen radical or plasma annealing unit comprising a gas source," which is a structural recitation.

The claims include structural recitations that differentiate the claimed apparatuses from the prior art. Accordingly, the claims are allowable over the rejections posed in the Final Office Action.

CONCLUSION

On the entire record and in view of all the cited references, Appellants submit that Claims 23-25, 27-35, and 45-66 are novel and non-obvious. Accordingly, it is respectfully requested that the Examiner's conclusions be reversed, and that this case be passed to issuance.

Respectfully requested,

Devin R. Jensen
Registration No. 44,805

20792
PATENT TRADEMARK OFFICE

CERTIFICATE OF MAILING

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to: BOX AF, Commissioner for Patents, Washington, DC 20231, on December 3, 2002.

Monica L. Croom

CLAIMS APPENDIX

23. An apparatus for forming a thin film on a substrate, the apparatus comprising:

a multi-functional chamber configured to deposit a dielectric layer on the substrate; and

an oxygen radical or plasma annealing unit connected to the multi-functional chamber and configured to provide oxygen radical or plasma gas to the multi-functional chamber to oxygen radical or plasma anneal one or more electrode and/or dielectric layers on the substrate in the multi-functional chamber, said oxygen radical or plasma annealing unit comprising a gas source selected from the group consisting of O_2, NH_3, Ar, N_2, and N_2O.

24. The apparatus of claim 23, wherein the oxygen radical or plasma annealing unit is an ozone generator or a plasma generator.

25. The apparatus of claim 24, wherein the multi-functional chamber further comprises an ozone remover connected to an exhaust end of the multi-functional chamber.

27. The apparatus of claim 23, wherein the multi-functional chamber comprises:

a support plate configured to hold the substrate;

a heater unit positioned under the support plate;

a source dispersion device positioned above the support plate and configured to uniformly disperse organic source liquid; and

a source supplier in fluid communication with the source dispersion device.

28. The apparatus of claim 27, wherein the source supplier comprises:

a liquid mass flow controller configured to control a flow of organic source liquid;

an evaporator in fluid communication with the flow controller and configured to evaporate the source liquid; and

a transfer gas source in fluid communication with the evaporator and configured to transfer an organic source from the evaporator to the source dispersion device.

29. The apparatus of claim 28, wherein the source supplier comprises between 1 and 3 evaporators.

30. The apparatus of claim 23, further comprising:

a cleaning gas supplier in fluid communication with the multi-functional chamber and configured to supply cleaning gas to remove dielectric material from a wall of the multi-functional chamber.

31. The apparatus of claim 23, further comprising:

a loadlock chamber configured to introduce the substrate into the apparatus; and

a transfer chamber connected to the loadlock chamber and configured to transfer the substrate from a first chamber to a second chamber, wherein the multi-functional chamber is connected to the transfer chamber.

32. The apparatus according to Claim 31, further comprising an electrode deposition chamber connected to the transfer chamber.

33. The apparatus according to Claim 31, further comprising a crystallization annealing chamber connected to the transfer chamber.

34. The apparatus according to Claim 31, further comprising an oxygen radical or plasma annealing chamber configured to pre-treat a lower electrode and connected to the transfer chamber.

35. The apparatus according to Claim 31, further comprising:

a cooling chamber connected to the transfer chamber; and

a pre-heating chamber connected to the transfer chamber.

45. An apparatus for forming a thin film on a substrate, the apparatus comprising:

a multi-functional chamber configured to deposit a dielectric layer on the substrate and configured to oxygen radical or plasma anneal one or more electrode and/or dielectric layers on the substrate, said multi-functional chamber comprising:

a support plate configured to hold the substrate;

a heater unit positioned under the support plate;

a source dispersion device positioned above the support plate and configured to uniformly disperse organic source liquid; and

a source supplier in fluid communication with the source dispersion device, said source supplier comprising:

an organic liquid source;

a liquid mass flow controller configured to control a flow of organic source liquid;

an evaporator in fluid communication with the flow controller and configured to evaporate the source liquid; and

a transfer gas source in fluid communication with the evaporator and configured to transfer an organic source from the evaporator to the source dispersion device;

an oxygen radical or plasma annealing unit connected to the multi-functional chamber and configured to provide oxygen radical or plasma gas to the multi-functional chamber to oxygen radical or plasma anneal one or more electrode and/or dielectric layers on the substrate in the multi-functional chamber, said oxygen radical or plasma annealing unit comprising a gas source selected from the group consisting of O_2, NH_3, Ar, N_2, and N_2O; and

a cleaning gas supplier in fluid communication with the multi-functional chamber and configured to supply cleaning gas to remove dielectric material from a wall of the multi-functional chamber.

46. The apparatus according to claim 45, further comprising:

a loadlock chamber configured to introduce the substrate into the apparatus; and

a transfer chamber connected to the loadlock chamber and configured to transfer the substrate from a first chamber to a second chamber, wherein the multi-functional chamber is connected to the transfer chamber.

47. The apparatus according to claim 46, further comprising an electrode deposition chamber connected to the transfer chamber.

48. The apparatus according to claim 46, further comprising a crystallization annealing chamber connected to the transfer chamber.

49. The apparatus according to claim 46, further comprising an oxygen radical or plasma annealing chamber configured to pre-treat a lower electrode and connected to the transfer chamber.

50. The apparatus according to claim 46, further comprising:
a cooling chamber connected to the transfer chamber; and
a pre-heating chamber connected to the transfer chamber.

51. An apparatus for forming a thin film on a substrate, the apparatus comprising:
means for forming a lower electrode on a substrate;
means for forming a dielectric layer on the lower electrode;
means for oxygen radical or plasma annealing the dielectric layer; and
means for forming an upper electrode on the oxygen radical or plasma annealed dielectric layer.

52. The apparatus of claim 51, wherein the means for forming a dielectric layer and the means for oxygen radical or plasma annealing the dielectric layer are in the same chamber.

53. The apparatus of claim 51, wherein the means for oxygen radical or plasma annealing the dielectric layer is a means for oxygen radical annealing the dielectric layer, and wherein the means for oxygen radical annealing the dielectric layer comprises a means for exposing the dielectric layer to an atmosphere comprising an oxygen radical.

54. The apparatus of claim 53, wherein the means for oxygen radical annealing the dielectric layer further comprises a means for maintaining the temperature of the dielectric layer equal to or less than 500°C.

55. The apparatus of claim 53, wherein the oxygen radical is ozone.

56. The apparatus of claim 51, wherein the means for oxygen radical or plasma annealing the dielectric layer is a means for plasma annealing the dielectric layer, and wherein the means for plasma annealing the dielectric layer comprises a means for exposing the dielectric layer to an atmosphere comprising a plasma gas selected from the group consisting of O_2, NH_3, Ar, N_2, and N_2O.

57. The apparatus of claim 56, wherein the means for plasma annealing the dielectric layer further comprises the step of maintaining the temperature of the dielectric layer equal to or less than 500°C.

58. The apparatus of claim 51, wherein the dielectric layer consists of a material selected from a group consisting of Ta_2O_5, Al_2O_3, TiO_2, Y_2O_3, $SrTiO_3$, $BaTiO_3$, $SrTiO_3$, $PbZrTiO_3$, $SrBi_2Ta_2O_9$, $PbZrO_3$, $LaZrO_3$, $PbTiO_3$, $LaTiO_3$, and $Bi_4Ti_3O_{12}$.

59. The apparatus of claim 51, further comprising a means for oxygen radical or plasma annealing the lower electrode.

60. The apparatus of claim 59, wherein the means for oxygen radical or plasma

annealing the lower electrode, the means for depositing the dielectric layer, and the means for oxygen radical or plasma annealing the dielectric layer are in the same chamber.

61. The apparatus of claim 59, wherein the means for oxygen radical or plasma annealing the lower electrode, the means for forming the dielectric layer, the means for oxygen radical or plasma annealing the dielectric layer, and the means for forming the upper electrode are within a single apparatus for forming a thin film.

62. The apparatus of claim 59, further comprising a means for crystallization annealing the dielectric layer.

63. The apparatus of claim 62, wherein the means for oxygen radical or plasma annealing the lower electrode, the means for forming the dielectric layer, the means for oxygen radical or plasma annealing the dielectric layer, the means for forming the upper electrode, and the means for crystallization annealing the dielectric layer are within a single apparatus for forming a thin film.

64. The apparatus of claim 51, further comprising a means for crystallization annealing the dielectric layer.

65. The apparatus of claim 64, wherein the means for oxygen radical or plasma annealing the dielectric layer and the means for crystallization annealing the dielectric layer are in the same chamber.

66. The apparatus of claim 64, wherein the means for forming the dielectric layer, the means for oxygen radical or plasma annealing the dielectric layer, the means for crystallization annealing the dielectric layer, and the means for forming the upper electrode are within a single apparatus for forming a thin film.